

Environmental DNA Sampling of Zooplankton Improves upon Arthropod Biodiversity Identification

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Identification and documentation of Earth's biodiversity has traditionally been a slow labor-intensive practice requiring taxonomic experts. Increased accessibility of environmental DNA (eDNA) and metabarcoding analysis of bulk samples though has the potential to increase the pace of documentation needed to record our present species richness before it is lost to climate change. Here we attempt to use metabarcoding in parallel with traditional direct sequencing to validate its use for zooplankton identification. I focused on arthropod zooplankters collected at midday and at night in front of Friday Harbor Laboratories, San Juan Island, Washington to compare metabarcoding and direct sequencing. Plankton samples were collected just below the surface using 153 μm mesh plankton nets by rowboat and divided in half by volume for comparison. One half of each sample was sorted into morphotypes by invertebrate zoology students who imaged and preserved unique morphospecies for direct sequencing. Geneious Prime was used to identify operational taxonomic units (OTU) from resulting contigs from both metabarcoding and direct sequencing of the metazoans barcode, cytochrome oxidase subunit 1. BLAST searches were run against Genbank, Midori, NOAA, and unpublished eDNA. Metabarcoding successfully identified 50% more OTUs than the students. However, 15 morphospecies not recognized in the metabarcoding dataset were collected by the class. Differences between arthropod assemblages depending on the time of day were captured by eDNA with only 40.98% OTU overlap between day and night samples. Our results support eDNA's use as a good identifier of total sample composition, but recognize manual techniques are necessary to capture rare plankton present in too low frequency to be documented by eDNA. Manual sorting and direct sequencing are still needed to identify new sequences and produce voucher images. The use of both techniques improves our ability to document existing biodiversity more rapidly before ecosystems are increasingly impacted by climate change.